

The Habitat Suitability Index: Strengths, Weaknesses, and Emerging Opportunities via Model Validation

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Habitat Suitability Indices (HSI) are a means to characterize the quality of habitat available for a particular taxa on a 0 to 1 scale from hostile to ideal environmental conditions. The index transforms qualitative concepts about a species niche into a quantitative metric that can be measured over space and time. The method is flexible to many applications, including modularity to focus on different species, regional locations, life stages, or habitat function (e.g., foraging, breeding). HSI is also intuitive and easy to set up in numerical models or spatial analysis. Finally, the parameters selected for HSI (e.g., depths, velocities) can be directly connected to design criteria.

Despite its popularity, HSI has shortcomings. An HSI may not perform well because of errors during habitat conceptualization, including underestimating the importance of temporal variability, species competition, or even environmental parameter selection. Additionally, there are pragmatic challenges related to the availability of observational data, how these data were collected or summarized, and the algebraic computation of the HSI. However, there are several techniques that can improve the effectiveness of HSI in field application, including desktop validation, probability analysis, and re-parameterization through monitoring in adaptive management. Furthermore, coupling habitat models with physical models, such as hydrologic and hydraulic engineering models, allows for inference to be made at a wider range of environmental conditions, improving scenario analysis, and model prediction capabilities.

The purpose of this presentation is to discuss the opportunities and pitfalls in HSI development and demonstrate how to improve the implementation of HSI for ecosystem management. Examples are focused on riverine habitats and leverage environmental flows analysis and hydraulic models. Methodologies to validate HSI at various temporal and spatial scales will be discussed. The nexus of river engineering, planning, and ecological expertise is emphasized as necessary interdisciplinary collaboration for effective HSI development and application.

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